

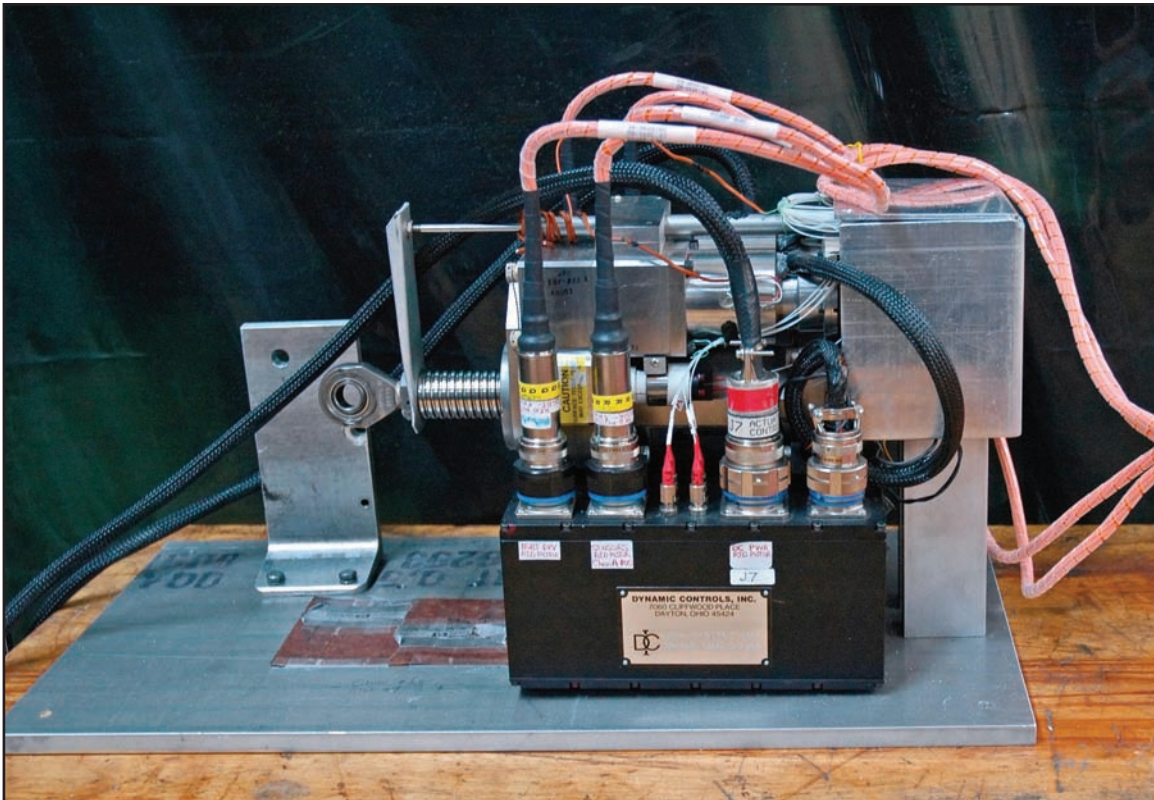


Air Force Research Laboratory|AFRL

Science and Technology for Tomorrow's Air and Space Force

TECHNOLOGY MILESTONES

AFRL DEVELOPS FLY-BY-LIGHT TECHNOLOGY



AFRL is developing fly-by-light technology flight control systems to be lighter and smaller, require less maintenance, and be more resistant to electromagnetic impulses than conventional fly-by-wire systems. AFRL's fly-by-light technology does not employ wires and is naturally resistant to electromagnetic interference (EMI), providing the same flight control capabilities as fly-by-wire systems without the necessity for shielding.



Air Force Research Laboratory
Wright-Patterson AFB OH

Accomplishment

AFRL teamed with Northrop Grumman; BAE Systems; and Dynamic Controls, Inc., to validate a fly-by-light, photonic-controlled actuation system (PCAS). The PCAS consists of a modified electromechanical actuator (EMA) and an optical controller that provides actuator commands to the optical EMA. These commands are similar to the commands that a flight control computer provides. Engineers modified the EMA's motor power devices to receive and react to command signals sent via light from the optical controller. In addition, they replaced the EMA's conventional sensors with optical sensors that measure actuator position, motor position, and current. Fiber-optic cables transmit information to the optical controller. Engineers collected EMA performance data during a series of test runs. Data analysis verified that the modified PCAS performed as designed, with no adverse effects to performance stemming from the fly-by-light components or technology.

Background

The EMA consists of two small electric motors, a gear train transmission, and an actuator ram (ball screw) that moves to operate an air vehicle flight control surface, such as an aileron. Conventional EMAs are just one part of an air vehicle's fly-by-wire flight control system, which supplements the pilot's control over the aircraft's control surfaces. Fly-by-wire systems use a closed-loop feedback system that can correct air vehicle instabilities many times faster than the pilot. It enables engineers to develop airframes capable of maintaining safe aircraft operations while meeting extreme mission needs such as low observability, high maneuverability, and long endurance.

Fly-by-wire system vulnerability to EMI is a concern, since EMI is present everywhere in the atmosphere (e.g., radar, radio signals, and lightning). These signals can couple onto the wires and circuits of unshielded electronic devices and cause erroneous signals that can disrupt the system. Currently, shielding protects fly-by-wire systems against EMI, and while shielding is effective, it adds weight, volume, expense, and timely maintenance requirements.

Additional Information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (VA-S-05-26)

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